



Heat Shield

User's manual

Document Heat Shield – User's manual

Pages 25

Revision list

Issue	Date	Author	Changed description
Origin		Reschiotto - Astori	

About this manual

The information contained in this manual may be changed without prior notification. No part of this manual may be reproduced, neither electronically or mechanically, under any circumstance, without the prior written permission of LSI LASTEM.

LSI LASTEM reserves the right to carry out changes to this product without timely updating of this document.

Copyright 2014 LSI LASTEM. All rights reserved.

Summary

1	Introduction.....	5
1.1	Models.....	5
1.2	Instruments description	6
2	Product installation	7
2.1	General safety rules.....	7
2.2	Mechanical installation and positioning.....	7
2.2.1	Installation with BVA325 support.....	8
3	How to use Heat Shield MASTER.....	9
3.1	Switching on	9
3.2	Changing the time	9
3.3	Displaying measurements	9
3.4	Switching off.....	10
3.5	Reset.....	10
3.6	Using the keyboard.....	10
3.7	Status bar.....	11
4	Using Heat Shield SATELLITE.....	12
4.1	Switching on/off	12
4.2	Reset	12
4.3	Using the keyboard.....	12
4.4	Diagnostics.....	12
5	Survey	14
5.1	Getting started	14
5.2	Setting a survey	14
5.3	Starting/Stopping a survey	15
5.4	Globe thermometer compensation.....	15
6	Setup.....	16
6.1	Menu navigation.....	16
6.2	Changing parameters	16
6.3	Utilities Menu	16
6.4	System parameters.....	17
7	Diagnostics.....	18
7.1	Error messages	18

7.2	Disabling error signalization	18
7.3	Error signalization during measurement	19
7.4	Low battery signalization.....	19
8	Maintenance.....	20
9	Accessories / Spare parts.....	20
10	Technical specifications	21
10.1	MASTER unit	21
10.2	SATELLITE unit	22
11	Examples.....	23
12	Disposal.....	25
13	How to contact LSI LASTEM.....	25

1 Introduction

Heat Shield is a compact measuring system including radiant temperature sensors, wet bulb temperature, air relative temperature and humidity for the calculation and display of globe temperature, wet bulb temperature, dry bulb temperature and relative humidity, displaying as well indoor&outdoor WBGT indexes, Heat Index and Humidex in a single unit.

Heat Shield MASTER module can support up to two SATELLITE units for the calculation of time-weighted WBGT index at three levels (as required by standard ISO 7243: 1989) or of all indexes in three different environments. Refer to chapter 11 for some examples of use.

Heat Shield can be connected to an anemometer; being so, it is able to acquire all the quantities needed to GIDAS TEA program for the calculation of other indexes for thermal comfort (PMV/PPD, TO, ISO 7730), thermal stress (PHS, ISO 7933) and cold stress (IREQ, Dlim, ISO 11079). GIDAS TEA allows you to perform in-depth analyses, simulations and reports.

Heat Shield provides also *MW6501 - LSI LASTEM products* DVD with *HS Manager* program installed. HS Manager allows you to transfer data from the instrument to your PC, perform analyses and evaluate the working limits of operators in the environments according to the variables defined in ISO 7243.

1.1 Models

Code (PN)	Description
ELR610M	Heat Shield MASTER module with small globe thermometer (5 cm diameter). Includes 110-220 Vac power charger, PC serial cable, USB adapter and HS Manager software.
ELR615M	Heat Shield MASTER module with standard globe thermometer (15 cm diameter). Includes 110-220 Vac power charger, PC serial cable, USB adapter and HS Manager software.
ELR610S	Heat Shield SATELLITE module with small globe thermometer (5 cm diameter).
ELR615S	Heat Shield SATELLITE module with standard globe thermometer (15 cm diameter).

1.2 Instruments description

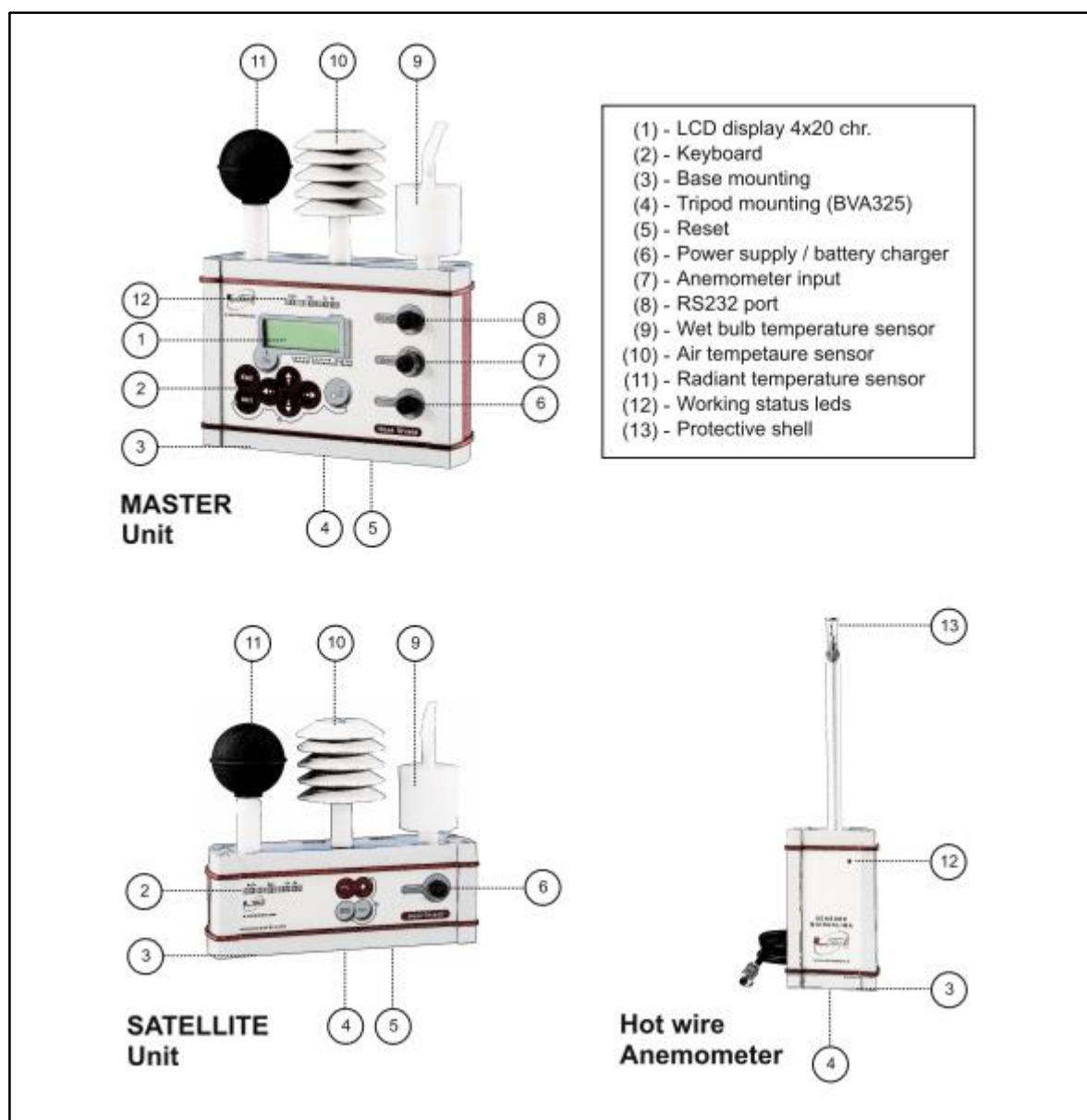


Fig. 1 – Instruments description.

2 Product installation

2.1 General safety rules

Please read the following general safety rules in order to avoid injuries to people and to prevent damages to the product or to products that may be used in connection with it. In order to avoid damages, use this product exclusively according to the instructions herein contained.

Installation and maintenance interventions are to be exclusively carried out by authorized and skilled people only.

Install the instrument in a clean, dry and safe place. Humidity, dust and extreme temperatures may deteriorate or damage the instrument. In such cases, we advise installing the instrument inside a suitable container.

Power the instrument in a suitable manner. Connect the instrument to the power supply indicated in the model in your possession.

Carry out the electrical wiring in an appropriate manner. Carefully follow the wiring diagrams supplied along with the instrument.

Do not use the product in case of suspected malfunction. In case of suspected malfunction, do not power the instrument; contact authorized technical support immediately.

Before every maintenance of electrical connections, power supply, sensors and computer-equipment:

- **disconnect the power supply,**
- **discharge the electrostatic discharges touching one conductor or one earth apparatus.**

Do not use the product in the presence of water or condensing humidity.

Do not use the product in a potentially explosive atmosphere.

Internal lithium battery. Do not replace the battery with incorrect type. Risk of explosion!

2.2 Mechanical installation and positioning

Heat Shield MASTER and SATELLITE can be placed on a flat surface or installed on a tripod. The choice is generally made based on the type of survey to be performed and to the ease of use. The tripod installation can be selected for surveys in *WBGT 1 amb.*, *WBGT 2 amb.*, *WBGT 3 amb.* modes without anemometer. Hot wire anemometers require the use of BVA325 support, which can be placed on a flat surface or mounted on a tripod. Cup anemometers require the use of BVA325 support, BVA308 pole and tripod.

Surveys in *subject WBGT* mode require the use of the tripod along with BVA326 pole and BVA325 support. Units must be positioned as indicated in **Errore. L'origine riferimento non è stata trovata..**

Some examples of use are described in chap. 23.

2.2.1 Installation with BVA325 support

BVA325 retention bracket can be used in different ways.

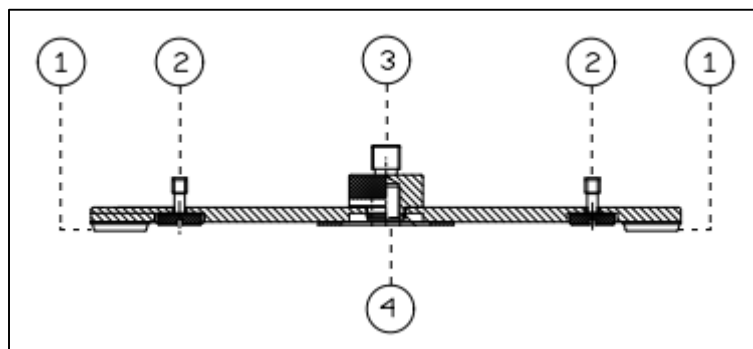


Fig. 2 - BVA325 retention bracket– Front view.

Heat Shield MASTER

Fasten the unit to one of the two available knurls (2) on the bracket. Mount the bracket on the tripod using the knurl (4).

Heat Shield MASTER and SATELLITE

Fasten the Satellite unit to the knurl (3) by means of the BVA326 pole. Fasten the MASTER unit to one of the two available knurls (2). Mount the bracket on the tripod using the knurl (4).

Hot wire anemometer

Screw the sensor onto one of the two available knurls (2); secure the MASTER unit to the other knurl (2). The bracket can be mounted on the tripod using the knurl (4) or placed on a flat surface. The rubber feet (1) allow the instrument to be stable.

Cup anemometer

Fasten the sensor to the knurl (3) using the BVA308 pole. Mount the bracket on the tripod using the knurl (4).

3 How to use Heat Shield MASTER




3.1 Switching on


Use  +  key combination to switch on the unit.

At each switch on, Heat Shield shows its ID data (PN, version and serial number) for a few seconds. Then the system time is displayed and finally the measurements.







```
LSI LASTEM Italy
HS001 V01.00.00
Heat Shield
SN 12345678
```

```
LANGUAGE
>English
Italian
Portuguese
```

During the first switch on Heat Shield prompts you to select the program language. Select the language using  and  and confirm with .

If the system time is correct, select  otherwise refer to the chapter concerning the system time change (§ 3.2).

3.2 Changing the time

Move the double cursor “^^” on the element to be changed using  ; increase or decrease the value with  . Press  to confirm the changes (the time of the second line is updated with the new value), then press  to exit.

```
SYSTEM TIME
30/09/14 09:31:23
30/09/14 09:24:15
^^
```

3.3 Displaying measurements

Heat Shield MASTER displays the indexes calculated according to reference standards and the measurements acquired by sensors (9) (10) (11) (see Fig. 1), either those physically connected to the instrument and those received by any SATELLITE units connected by radio.

The display is divided into groups. The first group to be displayed is that of MASTER unit indexes, followed by SATELLITE 1 (if any) and SATELLITE 2 groups (if any). These are followed by the group of MASTER measurements and subsequently by SATELLITE 1 (if any) and SATELLITE 2 (if any) ones.

```
WBGT_I 23.4 'C B=
WBGT_O 23.3 'C
```





```
WBGT_I1 23.4 'C B=
WBGT_O1 23.4 'C
```

```
WBGT_I2 23.3 'C B=
WBGT_O2 23.3 'C
```

```
t g 23.5 'C B=
t n w 23.2 'C
t a 23.2 'C
```




```
t g 1 23.6 'C B=
t n w 1 23.3 'C
t a 1 23.3 'C
```

```
t g 2 23.6 'C B=
t n w 2 23.4 'C
t a 2 23.4 'C
```

  keys allow you to scroll between one group and the other while   allow you to scroll through measurements vertically.

The first line is reserved to the status bar (see §3.7 for more info).

3.4 Switching off

To switch off the unit, go to the measurement mask, press  +  key combination and confirm with .



3.5 Reset

In case of incorrect operation (the *Ok* LED doesn't light up), power the instrument by connecting the power supply unit to the *Power* jack; after about ten minutes, reset the unit by removing the protective plug under the base and by pressing the internal button by means of a small pointed tool. Keep powering the instrument until the battery is fully charged (see §**Errore. L'origine riferimento non è stata trovata.**).





3.6 Using the keyboard

The keyboard consists of four directional keys and four function keys.







The following table summarizes the main functions of each key, according to the status of the instrument.

	Switch the unit on/off.
	Confirms switch off.



During menu display:

 	Scroll menu items upward and downward.
	Enters the menu item indicated by the ">" cursor. Changes the selection setting through the menu and returns to the previous menu (except for language).
	Exits the displayed menu and returns to the previous menu. If pressed in MAIN MENU, returns to the measurement display.

During measurement display:

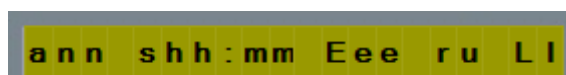
 	Scroll measurements/indexes upward and downward.
 	Call up the window with the previous/following group of indexes/measurements.
	Start survey (and data logging).
	Stop survey (and data logging).

During the display of the value edit mask (for example the SYSTEM TIME mask):

	Increase/decrease the value indicated by the cursor “^” or double cursor “^^”.
	Move the cursor “^” or the double cursor “^^” to the left/right.

3.7 Status bar

The status bar contains an overview of Heat Shield operating state. It is the first line in the measurement mask and is represented as follows:



where:

a: storage of measurements in progress. It appears only if the survey (and data logging) is enabled.

nn: survey identification number. It appears only if the survey (and data logging) is enabled

shh:mm: can have the following meanings:

- it is the time needed to reach the starting time of the survey if the survey is not in progress (ann is not shown) and the starting time has been already scheduled (s = '-');
- it is the time needed to reach the ending time of the survey if the survey is in progress (ann is shown) and the ending time has been already scheduled (s = '-');
- during survey (ann is shown), it is the time elapsed since the beginning of the survey. It is available only if survey end has not been scheduled (s = '+').

Eee: error number. It appears only if an error has occurred.



ru: radio signal with battery level. '-' radio on, '1' receiving data from SATELLITE unit 1, '2' receiving data from SATELLITE unit 2. It does not appear if in *WBGT 1 amb* mode (no SATELLITE is used).

LI: shows alternatively the (B)attery level and the (M)emory status.

(■ 100%: battery charge/memory full; □ 0%: discharged battery /empty memory; other levels shown: ■ 80%, ■ 60%, ■ 40%, □ 20%).

4 Using Heat Shield SATELLITE

4.1 Switching on/off

Press  +  key combination to switch on and off the instrument.



It is advisable to switch on the SATELLITE units only after switching on the MASTER unit to allow radio connection between units. The MASTER unit must be configured in the appropriate MODE (§ 5.2) to receive data transmitted by the SATELLITE units.

4.2 Reset

In case of malfunction (the *Ok* LED doesn't light up), power the instrument by connecting the power supply unit to the *Power* jack; after about ten minutes, reset the unit by removing the protective plug under the base and by pressing the internal button by means of a small pointed tool. Keep powering the instrument until the battery is fully charged (see § **Errore. L'origine riferimento non è stata trovata.**).

4.3 Using the keyboard

The keyboard consists of four keys and has the following features:

	Switch on/off the unit.
	Forces the connection of the radio with the MASTER unit . To be used if the MASTER unit was switched on after the SATELLITE unit.

4.4 Diagnostics

Heat Shield SATELLITE is provided with 4 illuminated indicators showing the following functions:

- *Rx/Tx*: Radio communication with MASTER unit; when connection is established with the MASTER unit, the indicator lights up in both units at the same time.
- *Batt*: the LED indicator is illuminated during the internal battery charge by means of the power supply unit connected to the *Power* input: the LED can have a high or a low luminous intensity, showing an intensive or maintenance charging current respectively. The LED indicator switches off when the battery is fully charged and can switch on during the maintenance charge.
- *Err*: indicates an error condition, typically due to a lack of connection with the MASTER unit. The number of flashes during a signaling cycle indicates the cause of the detected problem, as shown in the table below.
- *Ok*: indicates the on/off state and proper operation of the instrument.

Number of flashes	Typology of problem	Troubleshooting
1	The configuration memory is not working.	Try to reset the unit; consult your dealer if the problem persists.
2	The instrument cannot connect to the MASTER unit.	Make sure that the MASTER unit is on and located in close proximity to the SATELLITE unit; check that the two MASTER and SLAVE units make use of the same radio network number: when you have several MASTER units, these may have been configured to work with their corresponding SATELLITE units; therefore make sure to be using the proper and mutually compatible instruments. In case of failed connection, press the <i>Fn</i> key on the SATELLITE unit and check that the MASTER unit notifies the successful radio reception within a few minutes; otherwise, reset the unit (see §4.2).
3	The measuring system of the sensor is not working.	Try to reset the unit; consult your dealer if the problem persists.
4	The configuration data of the unit are not correct.	Try to reset the unit; consult your dealer if the problem persists.
5 o 6	Internal error	Try to reset the unit; consult your dealer if the problem persists.

5 Survey

After switch on, the Heat Shield is in acquisition status: it starts reading and displaying the measurements of its sensors and the ones transmitted by the SATELLITE units every 10"; while in this status, the adaptation conditions of sensors can be checked before performing their recording.

When launching the survey, (§5.3) the instrument starts logging the measured data, calculating their mean value and recording results every minute. Measurement and display are in any event performed every 10", even in logging conditions.

Wind speed measurement is performed in a slightly different manner, in that the value is sampled by the anemometer every second and rolling average measured by using the previous 60 samples; the display shows both measurements: the last acquired instant value and the rolling average value. The recorded data is in any event the average measured every minute.

Thermal stress indexes are also calculated with 10" rate and recorded as mean value every minute.

5.1 Getting started



1. Make sure batteries are fully charged, otherwise use the supplied power supply units.
2. Make sure there is enough memory available in the MASTER unit to store the data of the surveys to be performed.
3. Mount and position the instruments based on the desired calculation typology. In this respect, see the examples given at the end of the manual.
4. Switch on the MASTER unit and subsequently SATELLITE units, if used.
5. Check the reception of the measurements coming from the sensors in use on the Heat Shield MASTER display, especially those of SATELLITE units, if used.
6. Let sensors acclimate checking for stable measurements on the display. The globe-thermometer may need a 20-minute acclimatization period.



5.2 Setting a survey

Access the *Setup survey* menu and set in the following order:

1. **First survey nr.:** after executing a survey, the instrument associates a progressive number to each survey starting from the set value. During the measurement campaign, it can be useful to assign a numbering scheme to each survey; in this case, set a value from 1 to 99 or leave the default value.
2. **Mode:** select *subject WBGT 1 env.*, *WBGT 2 env.*, *WBGT 3 env.*, *WBGT subject* based on the type of survey you wish to execute. See chapter 11 for some sample images.
3. **Anemometer:** If no anemometer is connected, select *Not used*, otherwise specify the type: *Hot wire* or *Rotor*.
4. **Measure unit:** select *Celsius* or *Fahrenheit* to set the measurement unit used by the instrument.
5. **Start/Stop:** select the startup mode (manual/at given time) and stop mode (manual/ at a given time /after a given time) of the survey. Starting the survey activates measurement storage in the memory.

5.3 Starting/Stopping a survey

Surveys are started and stopped (data logging) based on the settings stored in the instrument. If you select the *Manual* startup, press  +  to start the survey (and measurement logging).

To stop the survey, press  + . Pressing these keys stops the survey even if an automatic stop has been set.

5.4 Globe thermometer compensation

Heat Shield models equipped with a small-sized globe thermometer (diam. 5 cm), use a compensation algorithm to obtain measurements equal to those obtained by a standard globe thermometer (diam. 15 cm). The formulas used are derived from EN ISO 7726:2001 regulation which specifies different equations based on convective regimes, natural or forced, the sensor is exposed to.

Heat Shield continuously determines the convective regime based on the following considerations:

- If the anemometer measures an air speed greater than 0,176 m/s, the convective regime is forced, otherwise it is natural.
- If the instrument doesn't use an anemometer, the convective regime will be the natural one, as there is no air speed measurement value to be taken into consideration.
- The air speed measurement used in the compensation formula is that calculated as the last minute moving average, to adapt to the measuring inertness of the globe thermometer, markedly higher than that of the anemometer.

It is important to note that if Heat Shield is programmed to use the hot wire anemometer (see §5.2), where this is not connected to the MASTER unit, a measurement error will be signaled ('---') and consequently also the globe thermometer measurement along with all related calculated indexes will be signaled as fault. It is therefore important to consider this potential situation in the event an inexplicable error condition is detected in these data.


The compensation of the globe-thermometer temperatures measured by the SATELLITE units will take the convective regime deriving from the air speed measured by the MASTER unit, since SATELLITE units do not provide this type of measurement.

It is important to point out that the MASTER unit equipped with a small-sized globe thermometer cannot use data provided by SATELLITE units equipped with big-sized globe thermometers and vice versa, since compensation functions would (or would not) be improperly applied to the MASTER unit.





6 Setup

Heat Shield is factory-configured. Some operating parameters can be menu displayed and changed.

6.1 Menu navigation

Press  in the measurement mask to access the main menu.

The first line in the menu is reserved for the title.







Use   to scroll the menu items; press  to enter the item pointed to by the cursor ">" and  to return to the previous menu (it returns to the measurement display if pressed in main menu).

6.2 Changing parameters

Depending on the type of parameter, changes can be made by selecting an element displayed in the menu or by changing the value using the arrow keys. Language selection is an example of menu-driven change while time setup is an example of change using arrow keys.

6.3 Utilities Menu

Heat Shield is provided with an UTILITIES menu that allows access to the following functions:

- Memory:** the instrument shows the percentage of available memory, which is useful for data logging; the same information is more approximately shown in the status bar (**\$Errore. L'origine riferimento non è stata trovata.**). This function allows you to erase the data memory and at the same time the log memory, where start/stop logging-related events and other diagnostic details are stored, using  +  key combination. Attention: make sure to transfer the logged data to your PC before erasing the memory! Data memory is used only when survey recording has been activated (see **\$Errore. L'origine riferimento non è stata trovata.**). Autonomy depends on the set MODE and is illustrated in the table below.
- Communications:** this function indicates bytes and messages received and transmitted by the instrument during communication with your PC (C1) and SATELLITE units (C2). Use  and  keys to move from C1 to C2 and vice versa.
- System errors:** indicates any errors detected by the instrument during operation. The error report is stored until user recognition; it may therefore indicate a previous error condition, which has been already settled but not yet recognized. Use  +  key combination to clear the fault condition.

Mode	Data columns produced	Autonomy (dd)
WBGT 1 environment	9	134
WBGT 2 environment	17	70
WBGT 3 environment	25	48
WBGT subject	23	52

6.4 System parameters

Besides survey parameters, indicated in §5.2, the instrument uses some system settings relating to other functions. These parameters, available in the SYSTEM menu, are:

- **System time:** allows you to adjust the date/time setting in the internal clock; for safety purposes this adjustment is required with instrument start up.
- **Acoustic alerts:** the internal buzzer can be activated in the following situations:
 - At the touch of a button.
 - During storage of survey start/stop.
 - In the event of operating errors.
- **Radio:** Heat Shield uses a radio able to operate in one of the possible 9 logical instrument networks; in the event only one MASTER unit is used with one or two SATELLITE units, this parameter doesn't need to be changed; otherwise, in the presence of more than one MASTER unit within an area where the units might interfere with each other, the parameter will need to be changed by selecting an unique network number as compared with the other devices; at the same time, you will have additionally to change the network number of the SATELLITE units belonging to your MASTER unit; consult your Heat Shield dealer to change this parameter.
- **Comm. port:** allows you to select a communication speed depending on the maximum performances that can be reached by the communication port used on your PC. By default, the instrument uses its maximum reachable speed (115200 bps).
- **Display auto off:** you can ask your instrument to switch off the display after the keyboard has been unused for some minutes, for energy saving purposes; the instrument functions remain still active even with the display switched off; the instrument indicators will show the on/off state.
- **Language:** the user interface has multiple languages available; use this function to select the desired language.

7 Diagnostics

7.1 Error messages



Heat Shield may indicate operational errors in different ways:

- *E* is displayed on the status bar.
- Audible signal (if enabled, see *Acoustic Alerts*, §6.4).
- The red indicator *Err* on the instrument keyboard flashes: the flashing modes indicate the error typology based on the table below:

Number of flashes	Problem typology	Troubleshooting
1	Log memory full	The space available for event logging is nearly or completely finished. Stop measurement logging as soon as possible, transfer data to your PC and erase data from memory (see <i>Memory</i> , § Errore. L'origine riferimento non è stata trovata.).
2	Low battery level	The battery charge of the MASTER unit and/or the SATELLITE unit has been detected to be below low limit; use the status bar to check which unit should be connected to the external power supply device to charge its own battery; wait for the charge indicator led to switch off before disconnecting the instrument from power supply source.
3	Radio	The instrument indicates a fault to the radio and consequently cannot receive the data measured by the SATELLITE units; contact your dealer for this kind of problem.
4	Data logging	The instrument indicates a fault to the data logging system; transfer immediately the data to your PC, then erase the data from memory (see <i>Memory</i> , § Errore. L'origine riferimento non è stata trovata.) and perform a survey with storage testing; contact your dealer if the problem persists.
5	Configuration	The instrument indicates a fault in configuration data; contact your dealer for this kind of problem.
6	Data memory	The instrument has detected a severe fault in the use of data memory; contact your dealer for this kind of problem.
7	Sensor sampling	The sensor measuring electronics is detecting an internal fault; contact your dealer for this kind of problem.
8	Communication	The system of interpretation of commands sent by your PC is detecting a fault condition; check the connection cable and the communication port used on your PC, if necessary also with another instrument; try to reduce the communication speed (see §0); contact your dealer if the problem persists.

7.2 Disabling error signalization

There are two possibilities to disable error signalization:

- 1) With the error code displayed in the UTILITY mask, press  and  to reset the error condition.
- 2) During data transfer between instrument and PC: in this case the instrument resets the error since it considers the error to have been already detected by the computer operator.


7.3 Error signalization during measurement

Measurement values can indicate the error status, marked by the indication '---', under the following conditions:

- Acquired measurement:
 - Sensor interrupted or faulty.
 - If the measurement comes from a SATELLITE unit: SATELLITE sensor interrupted or faulty or transmission not receivable by the MASTER unit; move the SATELLITE unit in proximity of the master unit and check reception conditions on the status bar; gradually distance the SATELLITE unit checking each time the correct reception of the signal by the MASTER unit.
 - Sensor not connected: if the use of a hot wire anemometer has been programmed, (see §5.2), and the sensor is not connected, the corresponding measurement fault will be signaled. Take into consideration the compensation function of the globe thermometer (see §5.4).
- Index measurement:
 - Off scale or faulty value of one or more measurements for index calculation.
 - If the measurement comes from a SATELLITE unit: off scale or faulty value of one or more SATELLITE measurements for index calculation, or transmission not receivable by the MASTER unit; follow the indications referred to in the preceding subparagraph.

When the number to be displayed is < -999999 or > 9999999, E-Log signals an overflow error by the message "Overfl."

7.4 Low battery signalization

A low battery status is signaled by the -Err LED blinking on the data logger; the blinking LED condition on the instrument disappears automatically when the battery is fully charged.

When the battery voltage is very low, the instrument might work abnormally, or might not switch on at all; it might also switch on and off continuously. If this is the case, we recommend to switch off the instrument and keep it charging for enough time to fully recharge the battery; then proceed to save the data in your PC and erase data memory.

8 Maintenance

Heat Shield MASTER and SATELLITE units are precision units. The instrument can operate for a long time without any significant problems or maintenance requirements. To make sure that the instrument does not exceed the measurement accuracy value indicated in the technical characteristics over time, LSI LASTEM recommends to calibrate the instrument yearly. We also propose to replace the relative humidity sensors with a frequency based on the operational conditions the instrument has been subject to, considering that long-lasting conditions of high humidity levels, pollution, presence of dust and chemicals lead to a faster deterioration of the sensitive element. It is however good practice to replace the relative humidity sensor every two years.

Consider also that the wet bulb thermometer sleeve should be replaced when it becomes dirt or deteriorated.

9 Accessories / Spare parts

PN	Description
BVA304	Tripod
BWA048	Soft bag for tripod and supports
BVA325	Support for Heat Shield and ESV125 anemometer when installed on tripods or surfaces and DNA205 anemometer
BVA326	Tripod extension for 3-level measurements and/or BVA308 mounting
BVA308	H.80 cm pole for DNA205 anemometer installation on tripod
ESV125	Hot wire anemometer
DNA205	Cup anemometer
BWA317	Carrying case for 1 ELR610M and 2 ELR610S modules plus accessories
BWA318	Carrying case for 1 ELR615M and 2 ELR615S modules plus accessories

10 Technical specifications

10.1 MASTER unit

Acquired measurements			
Measurement	Type	Measur. scale	Accuracy
Natural wet bulb thermometer	1/3 DIN-A Pt100	-20 ÷ 100 °C	±0.3 °C (@ 25 °C)
Globe thermometer ELR610M (sphere Ø 5 cm, 2 inch) ELR615M (sphere Ø 15 cm, 6 inch)	1/3 DIN-A Pt100	-20 ÷ 100 °C	±0.3 °C (@ 25 °C)
Environmental thermometer	Silicon band-gap	-20 ÷ 60 °C	±0.3 °C, ±0.4 °C (@10, 40 °C), ±0.8 °C (@60 °C)
Relative humidity sensor	Capacitive (replaceable)	0 ÷ 100 %	1.8 % (10 ÷ 90 %)
ESV125 – Air flow (optional)	Hot wire (tungsten wire Ø 9.45 µm)	0.01 ÷ 20 m/s	±10 cm/s (0.5 ÷ 1.5 m/s) 4 % (< 1.5 m/s)
DNA205 – Anemometer for outdoor use (optional)	Reed relay	0 ÷ 0.75 m/s	2.5 %
Indexes			
WBGT (indoor) WBGT (outdoor)	According to ISO7243. For up to three locations simultaneously (requires two SATELLITES units)		
Head-Torso-Ankle Weighted Average WBGT	According to ISO7243 (requires two SATELLITES units)		
Heat Index	According to National Weather Service (NWS) Technical Attachment (SR 90-23)		
Humidex	According to J.M. Masterton and F.A. Richardson of Canada's Atmospheric Environment Service equation (1979)		
Elaboration of the measurements			
Sampling rate	10'' for all the acquired and calculated measurements, except for Va (anemometer) which is sampled every 1''		
Recording rate	60'' as average value of sampled measurements		
Connectors			
Anemometer	For ESV125 hot wire and DNA205 cup anemometer		
RS232 serial line	1200 ÷ 115200 bps		
Power/Charger	8 ÷ 14 Vdc		
Radio			
Type	ZigBee		
Frequency	ISM 2.4 GHz direct sequence channels		
Power	10 mW (+10 dBm)		
Power			
Input voltage	8 ÷ 14 Vdc		
Consumption	TBD		
Battery			
Type	2 Ah (4.2 V) Lithium rechargeable		
Recharging time	~ 8 hrs		
Battery life	TBD		
Other features			
Internal calendar clock	Format: day-month-year hour-minutes-seconds Drift: 30 seconds/month (@ Tamb = 25 °C)		
Display	LCD 4 x 20 alphanumeric characters		
Keyboard	Membrane, 8 keys, operating status indicators (LED), communication from and to external devices, battery charger		
Processor	1 RISC 8 bit, clock 32 MHz		
ADC resolution	18 bit rounded to 16 bit Sample duration (rejection 50/60 Hz): 80 ms @ rejection 50 Hz		
Environmental limits	-20 ÷ 60 °C, 15 ÷ 100 % UR (not condensing)		
Mechanical protection	IP 54		
Weight	1.4 kg		

Dimensions	185 x 220 x 55 mm
Mounting	On level ground or on tripod by means of BVA325 and BVA326 supports

10.2 SATELLITE unit

Acquired measurements			
Measurements	Type	Scale	Accuracy
Natural wet bulb thermometer	1/3 DIN-A Pt100	-20 ÷ 100 °C	±0.5 °C (@ 25°C)
Globe thermometer ELR610M (sphere Ø 5 cm, 2 inch) ELR615M (sphere Ø 15 cm, 6 inch)	1/3 DIN-A Pt100	-20 ÷ 100 °C	±0.5 °C (@ 25°C)
Dry bulb thermometer	Silicon band-gap	-20 ÷ 60 °C	±0.3 °C, ±0.4 °C (@10, 40 °C), ±0.8 °C (@60 °C)
Relative humidity sensor	Capacitive (replaceable)	0 ÷ 100 %	1.8 % (10 ÷ 90 %)
Elaboration of measurements			
Sampling rate	10’’ for all acquired measurements		
Transmission rate	10’’		
Connectors			
Power/Charger	8 ÷ 14 Vdc		
Radio			
Type	ZigBee		
Frequency	ISM 2.4 GHz direct sequence channels		
Power	10 mW (+10 dBm)		
Power			
Input voltage	8 ÷ 14 Vdc		
Consumption	TBD		
Battery			
Type	2 Ah (4.2 V) Lithium rechargeable		
Recharging time	~ 8 hrs		
Battery life	TBD		
Other features			
Keyboard	Membrane, 8 keys, operating status indicators (LED), communication from and to external devices, battery charger		
Processor	1 RISC 8 bit, clock 16 MHz		
ADC resolution	10 bit		
Environmental limits	-20 ÷ 60 °C, 15 ÷ 100 % UR (not condensing)		
Mechanical protection	IP 54		
Weight	1.05 kg		
Dimensions	185 x 150 x 55 mm		
Mounting	On level ground or on tripod by means of BVA325 and BVA326 supports		

11 Examples



Fig. 3 - WBGT 1 environment measurement and index from MASTER unit only.



Fig. 4 - WBGT environments: separate measurements and indexes from MASTER unit and one SATELLITE unit.

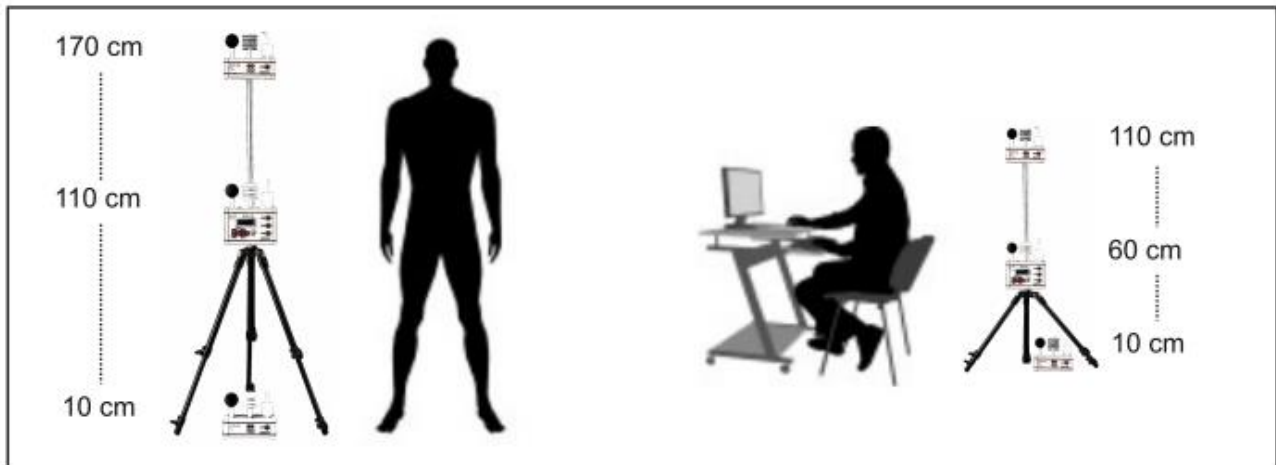


Fig. 5 - WBGT environments: separate measurements and indexes from MASTER unit and one SATELLITE unit.

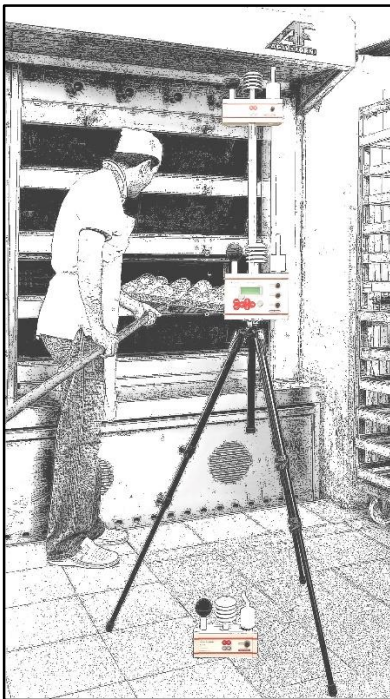


Fig. 6 - WBGT subject: measurements and indexes averages from one MASTER and two SATELLITE units.

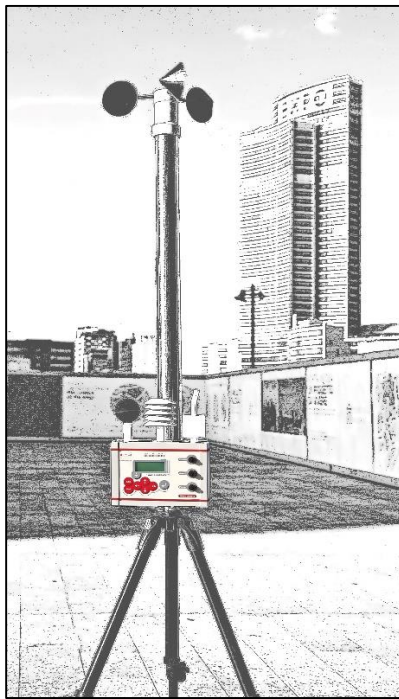


Fig. 7 - Usage of WBGT 1 env. with cup anemometer.

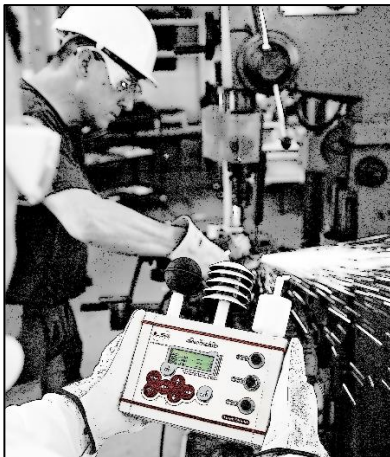


Fig. 8 - Use without data storing.

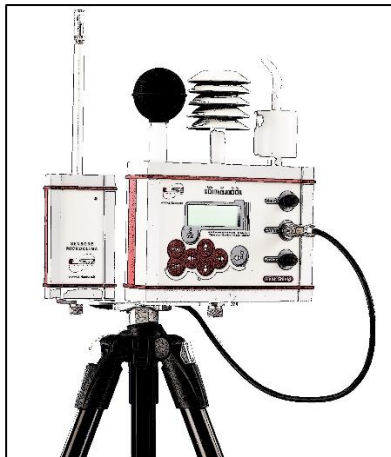


Fig. 9 - Usage of WBGT 1 env. with hot wire anemometer.

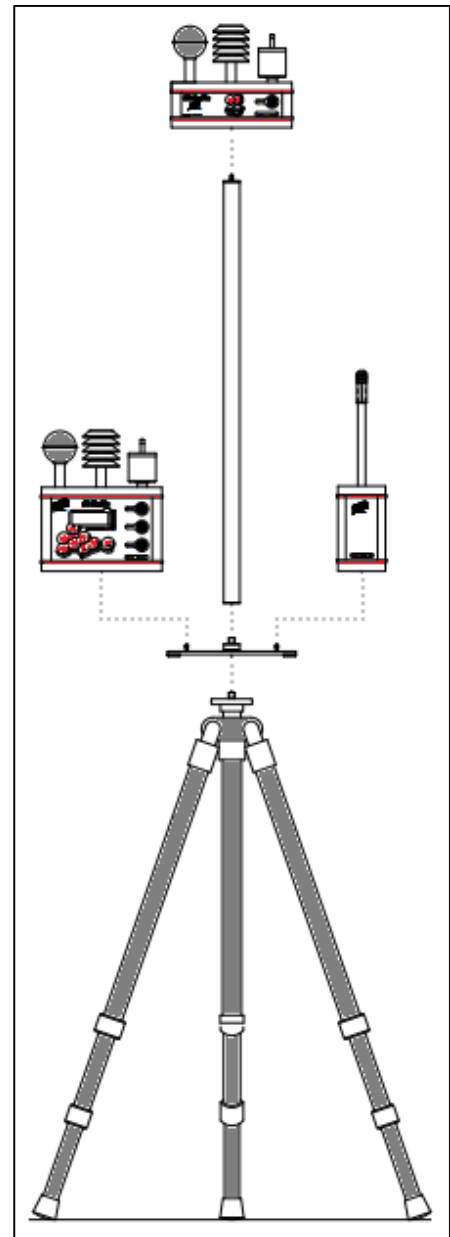


Fig. 10 - Exploded diagram.

12 Disposal

Heat Shield is a highly electronic scientific device. In accordance with the standards of environmental protection and collection, LSI LASTEM advises to handle M-Log as waste of electrical and electronic equipment (WEEE). It is therefore not to be collected with any other kind of waste.

LSI LASTEM is liable for the compliance of the production, sales and disposal lines of M-Log, safeguarding the rights of the consumer. Unauthorized disposal will be punished by the law. Dispose of the dead batteries according to the regulations in force.



13 How to contact LSI LASTEM

In case of problems contact the LSI LASTEM technical support at support@lsi-lastem.it, or fill in the *On-line technical support request* form accessible from the home page of the website www.lsi-lastem.it.

For further information:

- Telephone: +39 02 95.414.1 (switchboard operator)
- Address: Via ex S.P. 161 – Dosso n. 9 - 20090 Settala Premenugo, Milano
- Web site: www.lsi-lastem.it
- Sales: info@lsi-lastem.it
- After-sales service: support@lsi-lastem.it, riparazioni@lsi-lastem.it